

CLAIMS

1. A magnetic recording medium provided on a nonmagnetic substrate with at least an orientation-controlling layer for controlling orientation of a layer formed directly thereon, a perpendicularly magnetic layer having an easily magnetizing axis oriented mainly perpendicularly relative to the nonmagnetic substrate, and a protective layer, said medium being characterized in that said perpendicularly magnetic layer comprises two or more magnetic layers, that at least one of said magnetic layers is a layer having Co as a main component and containing Pt as well and containing an oxide and that at least another of said magnetic layers is a layer having Co as a main component and containing Cr as well and containing no oxide.
2. A magnetic recording medium according to claim 1, wherein said magnetic layer containing the oxide has magnetic crystal grains dispersed therein and said crystal grains penetrate the layer in columnar forms.
3. A magnetic recording medium according to claim 1 or claim 2, wherein said oxide is an oxide of at least one nonmagnetic metal selected from among Cr, Si, Ta, Al and Ti.
4. A magnetic recording medium according to any one of claims 1 to 3, wherein said oxide is Cr_2O_3 or SiO_2 .
5. A magnetic recording medium according to any one of claims 1 to 4, wherein said magnetic layer containing the oxide has an oxide content of 3 mol % or more and 12 mol % or less.
6. A magnetic recording medium according to any one of claims 1 to 5, wherein said magnetic layer containing the oxide has Co as a main component and has a Cr content of 0 at % or more and 16 at % or less and a Pt content of 10 at % or more and 25 at % or less.

7. A magnetic recording medium according to any one of claims 1 to 6, wherein said magnetic layer containing the oxide contains at least one element selected from the group consisting of B, Ta, Mo, Cu, Nd, W, Nb, Sm, Tb, Ru and Re and has a total content of said at least one element that is 8 at % or less.
8. A magnetic recording medium according to any one of claims 1 to 7, wherein said magnetic layer containing no oxide has Co as a main component and has a Cr content of 14 at % or more and 30 at % or less.
9. A magnetic recording medium according to any one of claims 1 to 8, wherein the magnetic layer containing no oxide has Co as a main component and has a Cr content of 14 at % or more and 30 at % or less and a Pt content of 8 at % or more and 20 at % or less.
10. A magnetic recording medium according to any one of claims 1 to 9, wherein said magnetic layer containing no oxide contains at least one element selected from the group consisting of B, Ta, Mo, Cu, Nd, W, Nb, Sm, Tb, Ru and Re and has a total content of said at least one element that is 8 at % or less.
11. A magnetic recording medium according to any one of claims 1 to 10, wherein said perpendicularly magnetic layer has the magnetic layer containing no oxide formed on the magnetic layer containing the oxide.
12. A magnetic recording medium according to any one of claims 1 to 11, wherein said perpendicularly magnetic layer contains two or more oxide-containing layers.
13. A magnetic recording medium according to any one of claims 1 to 12, wherein said perpendicularly magnetic layer contains two or more layers containing no oxide.

14. A magnetic recording medium according to any one of claims 1 to 13, wherein said perpendicularly magnetic layer has a nonmagnetic layer between said magnetic layers.

15. A magnetic recording medium according to any one of claims 1 to 14, wherein the perpendicularly magnetic layer comprises a plurality of magnetic layers each constituted of crystal grains, in which the crystal grains on an upper side are epitaxially grown from the crystal grains on a lower side.

16. A magnetic recording medium according to any one of claims 1 to 15, wherein each of said magnetic layers is constituted of at least one crystal grain and, during epitaxial growth of the at least one crystal grain constituting an upper magnetic layer from the at least one crystal grain constituting a lower magnetic layer, a ratio of the first mentioned at least one crystal grain to the second mentioned at least one crystal grain corresponds to one to one, one to plurality or plurality to one.

17. A magnetic recording medium according to any one of claims 1 to 16, wherein said perpendicularly magnetic layer has a ratio of one to one, one to plurality or plurality to one, which ratio is given to at least one crystal grain of the magnetic layer containing the oxide and at least one crystal grain of the magnetic layer containing no oxide, and wherein said at least one crystal grain on an upper side is epitaxially grown from said at least one crystal grain on a lower side.

18. A method for the production of a magnetic recording medium provided on a nonmagnetic substrate with at least an orientation-controlling layer for controlling orientation of a layer formed directly thereon, a perpendicularly magnetic layer having an easily magnetizing axis oriented mainly perpendicularly relative to the nonmagnetic substrate, and a protective layer, said method being characterized by forming said perpendicularly magnetic layer of two or more magnetic layers, wherein at least one of said two or more magnetic layers is a layer having Co as a main component, containing Pt as

well and containing an oxide and at least another of said two or more magnetic layers is a layer having Co as a main component, containing Cr as well and containing no oxide.

19. A method according to claim 18, wherein said magnetic layer containing the oxide has magnetic crystal grains dispersed therein and said crystal grains penetrate said layer in columnar forms.

20. A method according to claim 18 or claim 19, wherein the magnetic layer containing no oxide is disposed on the magnetic layer containing the oxide.

21. A method according to any one of claims 18 to 20, wherein said perpendicularly magnetic layer contains two or more oxide-containing layers.

22. A method according to any one of claims 18 to 21, wherein said perpendicularly magnetic layer contains two or more layers containing no oxide.

23. A method according to any one of claims 18 to 22, wherein said perpendicularly magnetic layer has a nonmagnetic layer between the magnetic layers.

24. A method according to any one of claims 18 to 23, wherein said perpendicularly magnetic layer has a ratio of one to one, one to plurality or plurality to one, which ratio is given to at least one crystal grain of the magnetic layer containing the oxide and at least one crystal grain of the magnetic layer containing no oxide, and wherein said at least one crystal grain on an upper side is epitaxially grown from the at least one crystal grain on an upper side.

25. A method according to any one of claims 18 to 24, wherein said perpendicularly magnetic layer is formed using a film-forming gas to which an oxygen gas is added.

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26. A magnetic recording and reproducing apparatus furnished with a magnetic recording medium and a magnetic head for recording and reproducing information in said magnetic recording medium, said apparatus being characterized in that said magnetic recording medium is the magnetic recording medium set forth in any one of claims 1 to 17.